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Wall Finishes for Kitchens, Utility and Bathrooms

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CONTENTS

* * *

Summary	3
Introduction	5
Survey of Problems, Opinions and Preferences of Homemakers	6
Wall Finishes in Kitchens	6
Wall Finishes in Bathrooms	9
Wall Finishes in Utility Rooms	10
Wall Finishes Available on the Market	10
Laboratory Studies of a Selected Group of Wall Finish Materials	11
Comparative Costs of Different Finishes	22
List of Selected References	25
Appendix	26

This publication was drafted by Elaine K. Weaver, Katherine B. Bailey and Velma V. Everhart and approved by the Subcommittee on Farm House Requirements.

Information in this publication, in addition to that obtained in Hatch 80-2 (NC-9), has been taken from "A study of sources and a compilation of consumer information of interior wall finishes", Katherine Brundlett Bailey, 1954, Unpublished Master's Thesis, The Ohio State University.

Some of the more popular information concerning choice and application of finishes, methods of cleaning and special characteristics of the various materials will be reported in "Wall Finishes", MM132, Agricultural Extension Service, The Ohio State University in Cooperation with The Ohio Agricultural Experiment Station

WALL FINISHES FOR KITCHENS, UTILITY AND BATHROOMS

**ELAINE KNOWLES WEAVER, KATHERINE BRUNDLETT BAILEY
and VELMA VIZEDOM EVERHART**

S U M M A R Y

The wall finishes of the rooms in which we live may not only effect us aesthetically but may make the difference between ease and drudgery in their care, particularly in areas such as kitchens, utility or bathrooms. Requests for information concerning suitable finishes for walls prompted this second of two studies on finishes in homes.

To find out women's likes, dislikes and problems with wall finishes, 103 women were interviewed. While paint of some type was the predominate finish in kitchens, utility and bathrooms in most homes, women indicated that any material they would choose should be easily cleaned and replaced, attractive, durable and inexpensive. Problems were mainly confined to stains that were difficult or impossible to remove. Problem areas were those where the activity increased the probability of stains; such as, at range, sink, lavatory and dining center.

Materials selected for laboratory study included six types of paint, coated fabrics, wall paper, wallboard, plastic tile and aluminium tile. Seventeen different materials suggested as "stainers" were used in testing the stain resistance and washability of the materials.

When standardized methods for applying staining materials and washing finishes were used it was found that the finishes responded differently. A panel of three home economists scored the materials for extent of stain.

A better grade of two gloss paints, at least the more expensive, was superior in its resistance to staining and washability than was the cheaper brand. Both semi-gloss paints were superior to the cheaper gloss. The price differential of the semi-gloss paints seemed to make little or no difference in their performance. Both flat paints used were more susceptible to stain than any of the other paints used. The so-called "one-coat" variety of paint was good in performance. This was the only one of the paints that had not been given a two-coat application to test panels. It is fair to estimate that had two coats been used, it might well have been rated as a superior product. The rubber-base paints had good resistance to stain and satisfactory washability, as did the casein paint.

Wallpaper treated with a lacquer gave quite good resistance to stain and proved to be good as to washability. So-called washable wallpaper without treatment was very susceptible to stain and no cleaning treatment used proved to be particularly satisfactory.

Tests in this study did not include any that could be used to estimate durability or longevity of the finishes, but the material that proved most resistant to all stains and had the best washability was a wall board material made of gloss paint baked on felt. Its slick finish was superior and almost impervious to staining. Its performance was better than that of wall tiles made of plastic or aluminum with a baked-on paint finish. From the standpoint of "eye-appeal" the wall board was the least desirable. The scores for plastic and aluminum tile were quite similar and rated in the same class as the better gloss and semi-gloss paints.

For washability to remove stains, a mild soap and a wall cleaner, used by the majority of women interviewed, gave almost identical results as far as scoring was concerned. A mild scouring powder proved superior for the removal of stains on all finishes except casein paint. The durability of finishes cannot be predicted if such a product were used frequently over a period of time.

Stains giving the most trouble were caused by ink, lipstick, crayon, liquid rouge, shaving cream, chlorophyll tooth paste, shoe polish and mustard. Contrary to belief, such materials as chlorine bleach, liquid detergents, grape juice, hair oil, iodine, merthiolate, cold cream and mayonnaise did not prove to be particular problems except with untreated wallpaper.

Only green colors were used in this study. Tests to determine the effect of prolonged sunlight on finishes indicated little or no color change in any of the materials.

Costs of the wall finishes varied widely. For finishes alone without consideration of adhesive (if needed) or for labor for application, the prices per square foot were in the following order: flat paint and casein, \$0.008 to \$0.016; rubber-base paint, \$0.009 to \$0.011; semi-gloss paint, \$0.007 to \$0.018; gloss paint, \$0.013 to \$0.018; washable wallpaper, \$0.040 to \$0.170; coated fabric, \$0.08 to \$0.10; wall board \$0.10 to \$0.15; plastic tile, \$0.42 to \$0.47; and aluminum tile, \$0.47 to \$0.49.¹

¹Other materials such as laminated plastics, plastic vinyl, linoleum and ceramic tile were not considered in this study as they had been tested in a previous study and reported in Research Bulletin 764, **Work Counter Surface Finishes for Kitchens and Utility Areas**. Ohio Agricultural Experiment Station, Wooster, Ohio.

INTRODUCTION

When indoors, four walls and a ceiling always surround us and form the largest background area of the room. The finishes, their texture and color, have the power to make a room appear large or small, light or dark, and quieting, invigorating or confusing; they can well set the atmosphere of the room. Their appearance can add to or detract from the unified effect of the furnishings.

Each year, as more and more new wall finishes appear on the market, the problem of consumer decision as to the most suitable choice becomes more perplexing. Advertising through the media of colored magazine spreads and television has sparked new interests particularly in the "do-it-yourself" trend. Shorter working hours and longer weekends for the wage earner and increased labor costs have led to greater family participation in home improvement.

Homemakers, ever aware of the problems in care of walls, want to know about durability of different wall finishes, ease in cleaning, color choices, resistance to sunlight, ease of application and comparative prices. The lack of specific information concerning the advantages and disadvantages of the various products has brought numerous questions to the attention of salesmen, interior decorators and home economists.

Purpose for This Study

One of the purposes of this study was to find answers to some of the questions coming from residents of Ohio and other states for information as to the various materials available for walls and their suitability for different areas in the home. Recognizing that walls in kitchens, utility rooms and bathrooms are subjected to more adverse conditions than are those in other rooms in the house, the investigation was limited to the suitability of wall finishes in these rooms.

The main objectives of the investigation were to:

- (1) Find out (a) the variety of materials available for application to walls in kitchens, utility rooms and bathrooms; (b) information concerning the processes used in manufacturing that might give better understanding as to installation, use and care.
- (2) Find out homemakers' likes, dislikes and problems with various finishes as a guide to a laboratory investigation.
- (3) Evaluate representative materials under controlled laboratory conditions for such factors as durability and resistance to stain, abrasion and changes in color due to cleansing and sunlight.
- (4) Ascertain comparative costs of some of the most frequently used materials.

The procedures used and the results of the survey and laboratory study will be reported in the following sections.

SURVEY OF PROBLEMS, OPINIONS AND PREFERENCES OF HOMEMAKERS²

To learn of actual problems women encounter and their preferences in the use of different wall finishes, 103 Franklin County, Ohio, homemakers were interviewed. No attempt was made to get a representative sampling of the county. Homes were picked at random in each section of the city of Columbus and in each village and rural farm area. The questions and problems served to direct the laboratory activities in this study.

Over four-fifths of the families visited owned or were buying their homes. About one-fourth of the houses were less than a year old; half were 15 years old or less; 13 of the homes were from 50 to over 100 years old.

Fifty-two of the families had lived in these houses 5 years or less; 35 between 5 and 15 years and 16 families for more than 16 years.

WALL FINISHES IN KITCHENS

Types of Wall Construction Found in Kitchens



Plaster, known as wet wall construction, was found in 92 of the homes. The remaining 11 had walls made of 2 or more materials; namely, wood, wall board, plywood, ceramic tile and/or brick.

In 51 homes cracked plaster was presently or had been a problem before repair and had some bearing on the choice of the wall treatment. This problem had been solved with plaster filler in 20 homes, 7 others had replas-

tered, 4 used a coated fabric and 3 had pasted strips of old blinds over cracks before papering. Other methods employed included the application of acoustic ceilings, wall board, plastic tile and linoleum over old plaster.

²**Problems, Opinions and Preferences of 103 Franklin County Ohio Homemakers Concerning Wall Finishes of Kitchen, Bath and Utility Rooms.** Velma Vizedom Everhart, 1954, Unpublished Master's Thesis, The Ohio State University.

In 11 of the homes dry wall construction had been used. Eight of the women liked this type of construction as it was easily cared for. Three objected, saying that dry wall construction did not seem solid or had separated at the joints leaving objectionable cracks.

Wall Finishes in Kitchens

The number and combinations varied from 1 to 4 wall finishes in the kitchens with 19 different materials represented. Paint was the most frequently used finish. Oil base paints were used in 79 and emulsion paints in 6 of the 103 kitchens. Twenty-one families had used wallpaper, plastic or metallic tile; linoleum was found in 14 homes. When wallpaper was used, it was generally in combination with another finish serving as a wainscoting.

Problems Encountered in the Use of Wall Finishes

Problems with wall finishes seemed to be more closely related to definite areas in the kitchen than to specific finishes. Problem areas most frequently mentioned were:

Behind and over the range.....	by 87	homemakers
Behind the sink.....	by 27	"
Around doors.....	by 25	"
Behind and over the refrigerator.....	by 25	"
Around light switches.....	by 14	"
Near registers.....	by 12	"

Other spots mentioned included those around dining space, ventilating fans, waste baskets, telephone and door knobs.

Problem causes most frequently mentioned included:

Grease	by 66	homemakers
Finger prints.....	by 52	"
Grease film (range and furnace).....	by 27	"
Soap and detergents.....	by 20	"
Dust and lint.....	by 11	"
Steam from cooking.....	by 11	"

Other materials listed were colored crayons, foods such as mayonnaise and beets, ink, water colors and the like. Bumps and abrasion from toys, chairs and other objects were also cited. Most of the women considered a "problem" as one that was difficult to remedy whereas, finger marks and easily washed off materials were not considered real problems.

Frequency of Cleaning Wall Finishes

The frequency of cleaning wall surfaces seemed to be dependent upon the housekeeping standards of the individuals and thus were difficult to determine. When asked how frequently they cleaned their present kitchen walls, homemakers' answers varied from "haven't", "don't" and "once in 5 years" to "12 times a year". Approximately two-thirds of the rural and city and four-fifths of the village homemakers cleaned walls once or twice a year.

Products Used for Cleaning Wall Finishes

The list of cleaning products used by the 103 homemakers seemed to include everything on the store shelves and some unknown to the interviewer. Thirty-seven brand name products of powder, liquid and paste types were listed. One popular powdered brand led all others by far and was used in 51 of the 103 homes.

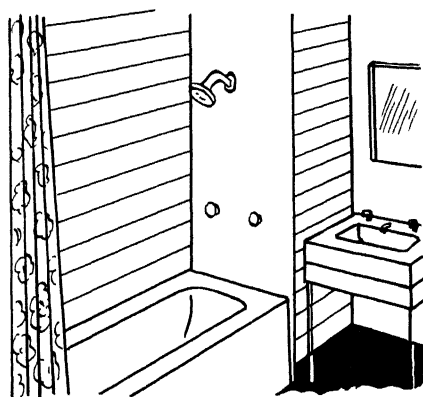
Replacement Preferences and Reasons for Choice

The women were asked what material they would use if they were to refinish their kitchen walls. The majority of women indicated that they would again use the same finish as was on the walls at the present time. In some homes having just one wall finish the women said that they would like to combine their present finish with another such as ceramic, plastic or metal tile--if family finances would allow:

The women reported that they liked paint because it is easily washed, easy to reapply and change color, inexpensive, durable, restful, good light reflection and does not fade. Coated fabric was popular because it is easily cleaned, attractive, hides plaster cracks and does not have to be replaced often. Paper was chosen because it is available in a variety of color and design, is easy to replace, covers wall blemishes, is inexpensive and can be applied by the homemaker or other family members.

Similar characteristics were cited for wood, tiles and other finishes. This indicated that, no matter which material was used, the women wanted it to be easily cleaned and replaced, attractive, durable, colorful and inexpensive. While some of the new materials such as laminated plastics, glass and ceramic tile offer the ultimate in color, durability and the like, only one woman listed her preference for such a material. This probably indicates that the family purse limits preferences to those that were considered to be within the family means or that the women were not acquainted with other materials.

WALL FINISHES IN BATHROOMS



Ninety-seven of the 103 homes where interviews were made had one or more bathrooms. As in the kitchens, plaster was the predominate structural treatment; likewise, enameled paint was the most commonly used finish. Forty-one homes had 1, 53 had 2 and 5 had 3 finishes per bathroom. Plastic, metallic or ceramic tile was used around the bathtubs and on the lower half of the wall area in 26 homes. Ceramic tile was

generally limited to the tub or shower area. Other materials used were coated fabrics, wall board with baked enamel finish, glass tile, structural glass, wallpaper and linoleum.

Problem areas in the bathrooms as indicated by the women were:

Behind lavatory.....	by 82	homemakers
Around tub.....	by 49	"
Under towel rack.....	by 25	"
Around soap dish.....	by 20	"
At shower.....	by 13	"
Near radiator or register.....	by 13	"
Behind toilet.....	by 11	"

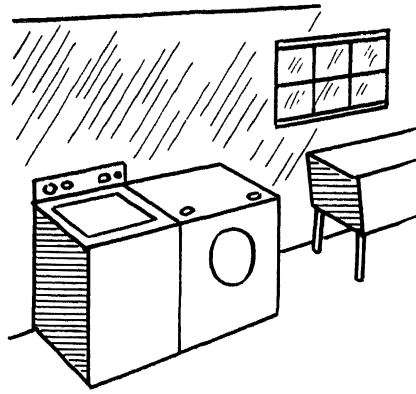
In homes where the above areas were surrounded by materials impervious to moisture and staining and were easily cleaned, they were not considered problems.

Stains and deposits from soap and/or hard water were mentioned as real problems by 89 of the 97 homemakers. Other problems had to do with tooth paste, fingerprints, shaving cream, urine, deodorants, crayon, pencil and ink. Oily film from furnaces was a problem in several homes.

The majority of the homemakers were satisfied with their present bathroom wall finishes and would use them again; however, several homemakers said they would like to combine the present finish with plastic, metallic or ceramic tile around tub and lower wall areas.

Cleaning practices and supplies were similar to those used by the women in their kitchens.

WALL FINISHES IN UTILITY ROOMS



Separate utility rooms were found in only 13 of the 103 homes visited. Wall construction materials were plaster in 9 homes; plywood, 2; wall board and wood, one each. Seven different applied finishes were observed with enamel paint being predominate. Only one type of wall finish was found in any one utility room.

Problem areas in the utility room were mainly around the washer and sink. Conditions and materials causing problems listed were soaps and synthetic detergents, steam and dampness. The care given to these rooms could hardly be compared to that in kitchens and bathrooms in most cases. The rooms were used principally for laundering and little thought had been given to appearance or attractiveness.

WALL FINISHES AVAILABLE ON THE MARKET

The exact number of wall-finish manufacturing companies was difficult to obtain but through **The Thomas Register of American Manufacturers**³ the number approximated was:

Paint and Varnish.....	150	Companies
Wallpaper	50	"
Plastic and Metallic Tile.....	50	"
Wall board.....	35	"
Ceramic Tile.....	10	"
Other	25	"

Letters were written to 150 national and local Ohio companies in the above listing. Letters to ceramic tile manufacturers were omitted since they had been contacted in a previous study on counter surface materials.⁴ Firms were asked if they made a product which was recommended specifically for kitchen, bath or utility rooms and, if so, to send data concerning their product, specific research reports and advertising materials.

³Thomas Register, 1952 Edition, Thomas Publishing Co., 473 8th Ave., New York 1, N. Y.

⁴**Work Counter Surface Finishes for Kitchens and Utility Areas**, Elaine Knowles Weaver and Velma Vizedom Everhart, North Central Regional Publication 52, Ohio Agricultural Experiment Station, Wooster, Ohio, 1955.

About 40 percent of the companies contacted replied. Of these about three-fourths maintained that their products were suitable for these rooms. Most of the material sent was that used for advertising although several companies sent educational materials such as the history of paint and color. Only one company enclosed information pertinent to research.

LABORATORY STUDIES OF A SELECTED GROUP OF WALL FINISH MATERIALS

It was recognized that laboratory tests could not duplicate home conditions in the use of wall finish materials. Nevertheless, subjecting the various materials under controlled conditions to certain treatments which might exist in homes was considered of value.

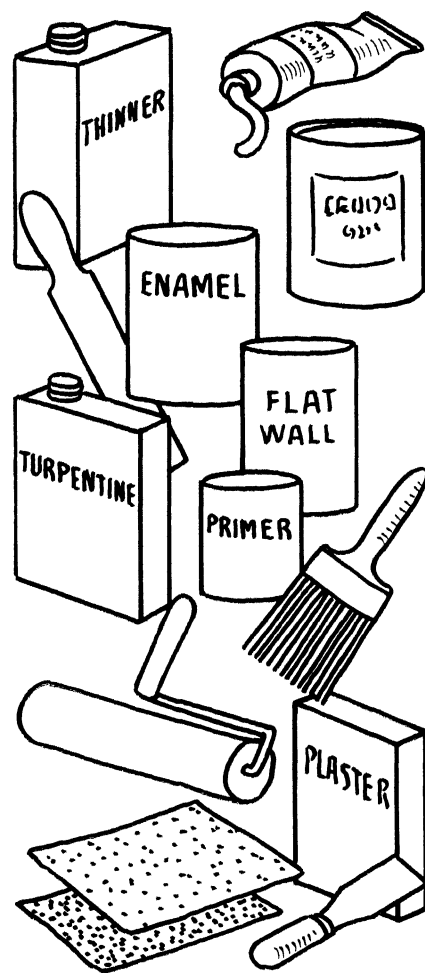
Classifications and Choice of Materials

Wide diversity in types and quality of products was found through correspondence and interviews with manufacturers, distributors, retailers, other researchers and in the literature. For the purposes of this study the materials have been classified into four main groups; namely, paint, wall paper and coated fabrics, flexible materials, and rigid materials. They are briefly described in the Appendix.

Since it is the policy of the Ohio Agricultural Experiment Station to avoid the use of trade or brand names or recommendations of any products, the materials used for this study will be known by the following code:

	Materials	Cost
Paints	Gloss 1	\$7.95 per gallon
	Gloss 2	9.10 per gallon
	Semi-gloss 1	7.21 per gallon
	Semi-gloss 2	5.90 per gallon
	Flat 1	4.89 per gallon
	Flat 2	4.80 per gallon
	Rubber-base 1	5.30 per gallon
	Rubber-base 2	5.89 per gallon
	One-coat	8.40 per gallon
	Casein	3.50 per gallon
Fabric and Paper	Coated fabric	\$2.40 per roll (6 yds., 24 in. wide)
	Wallpaper (washable)	\$1.50 per roll (5 yds., 24 in. wide)
	Wallpaper (treated)	\$1.90 (1.50 + .40 for lacquer—1 coat)
	Lacquer	.90 per qt. (covers 75 sq. ft.—1 coat)
	Wall board (flexible)	\$.16 per sq. ft.
	Tile	
	Plastic	\$.48 per sq. ft.
	Aluminum	\$.47 per sq. ft.

Procedures Used in the Study of Wall Finishes



Characteristics considered desirable for wall finishes as indicated by the homemakers interviewed included resistance to stain, cleanability, and ease of application. The two factors, resistance to stain and cleanability, were considered important and were most suitable for laboratory study.

The wide variety of materials and colors available made selection of a representative group difficult. Before making a selection of materials for study, all of the wall covering manufacturers and major dealers in Columbus, Ohio were interviewed. Dealers were asked concerning the most popular brands and colors of products sold. Those brands of each classification seemingly the most popular were chosen.

Because of the frequent questions concerning the range in cost and quality among paints of the same classification, a high priced and a lower priced brand were chosen from the gloss and semi-gloss types. There seemed to be less variation in costs of flat paints among the popular brands.

All materials were chosen in a light green color of as nearly the same hue and intensity as was possible. Several other paints were eliminated during the study because of difficulty in spreading for an even film or because colors were in too great a contrast. Figured coated fabric and wallpaper were also eliminated due to difficulties in judging color changes.

It was recognized that many, many more materials of popular use might have been considered but the time duration for study limited further sampling. Ceramic tile, laminated plastic panels and flexible

vinyl and linoleum coverings used for walls were not included since they had been given rigorous testing in a previous study. For ability of these materials to resist stain and damage from heat, moisture, and abrasion, see **Work Counter Surface Finishes for Kitchens and Utility Areas**, Research Bulletin 764, Ohio Agricultural Experiment Station, Wooster, Ohio, 1955 (North Central Regional Publication 52).

How Materials Were Studied

All materials studied were applied to pressed wood panels, 6¾ inches by 16 inches by ⅛ inches. The method of application of the material was dependent upon the nature of the finish.

Paints

All paints used were applied to test panels by means of a Boston-Bradley Blade.⁵ This device was composed of a rectangular shaped stainless steel bar having two blocks, one permanently attached to each end. The bar between the end blocks was of smaller height which allowed a clearance between the bar and the lower horizontal plane of the end blocks. A one-fourth inch thick right angle blade fit vertically between the 2 end blocks. A brass shim of .006 inch thickness was held by the blade. When a given amount of paint was placed in front of the blade, the panel was lowered and the blade drawn toward the operator at a uniform speed giving a film of pre-determined thickness.

After the application of paint, all panels were allowed to dry for 48 hours. They were then wiped with a cloth saturated with ethyl alcohol to remove finger marks or foreign particles. A second coat was then applied. (The one exception to the second application was the "one-coat" variety of paint which was promoted as a product requiring one application only.) Following the second coat, all test panels were allowed to stand 14 days prior to use for test purposes.

Coated Fabric and Wallpaper

Coated fabric and wallpaper were applied to the test panels by means of a wheat paste and were allowed to stand for at least one week prior to testing.

Duplicate panels of wallpaper were prepared and when paste was thoroughly dry, a clear lacquer was applied. When dried, a second coat was applied. The special lacquer was a brand highly advertised as a protective coating to make wallpaper resistant to stain and "scrubbable."

⁵Boston-Bradley Adjustable Blade, Garden Laboratory, Incorporated, Bethesda 14, Maryland.

Rigid Materials

Wall board and plastic and aluminum tiles were applied to the test panels by means of a special adhesive recommended for the purpose. The panels were allowed to stand for one week prior to testing.

Resistance to Stains

The choice of materials used for staining purposes was limited to those to which wall finishes in kitchens, utility rooms and bathrooms might be subjected; namely, ink, liquid detergent, chlorine bleach, lipstick, crayon, pencil marks, hair oil, liquid rouge, iodine, merthiolate, grape juice, shaving cream, chlorophyll tooth paste, mayonnaise, facial cold cream, shoe polish and mustard.

Staining and Treatment

Staining materials were applied to the test panels by means of a brush and a stencil allowing a $5\frac{1}{8}$ inch by $\frac{1}{2}$ inch application. Three to 5 staining materials were applied to each panel. Triplicate panels were made for each test.

A Gardner Washability and Abrasion Machine, Model 105⁶, was employed for standard washability in the determination of stain resistance of the various finishes. This device consisted of a metal table and pan used to hold the test panels, a brush box and an interchangeable sponge holder attached to a stranded stainless steel cable, a 110 volt, 60 cycle A.C. motor, a recording counter, and a cleansing solution container held in place by an "H" shaped bracket. The path of travel of the brush or sponge was 13 inches long and $1\frac{1}{2}$ inches wide. Symmetrically placed weights fastened to the brush box assembly brought the total weight to one pound. The speed of the brush was approximately 37 oscillations per minute. (See Appendix Figure 1).

To determine if the age of the stain increased resistance to removal in cleaning, one set of panels was washed two hours after staining materials were applied; another set was allowed to stand for 7 days.

Three different cleaning materials were employed and applied in the following manner:

(1) Mild soap granules⁷ were dissolved in distilled water at approximately 75° F. in amounts to provide a 0.5 percent solution. Five cubic centimeters of the solution were poured on each end of the test panel and the brush, which had been soaked in a separate soap solution for 5 minutes, was allowed to make 37 oscillations (one minute) or

⁶Gardner Washability and Abrasion Testing Machine, Model 105, Gardner Laboratory, Incorporated, Bethesda 14, Maryland.

⁷Mild unbuilt soap such as Ivory, Lux, or Chiffon.

74 separate strokes. Following the washing, the test panels were rinsed with one cup of distilled water and allowed to air dry at room temperature.

(2) The sponge was soaked in distilled water of room temperature until thoroughly saturated and was then rubbed across a cake of mild scouring material^b 25 times. The sponge was allowed to make 37 oscillations across the test panel. The panels were then rinsed with one cup of distilled water and air dried.

(3) A brand name powdered wall cleaning material^a used by the majority of homemakers interviewed was used in an amount to make a 0.3 percent solution. Procedures used were the same as with mild soap.

Light reflectance readings were made of stained materials both before and after washing.

A panel of three judges rated the extent of the remaining stain, using the values below:

- 5 points—no visible stain
- 4 points—slight visible stain or change in color
- 3 points—moderate stain
- 2 points—badly stained
- 1 point—stain of same intensity as original

Results of Tests on Resistance to Stain

When the judges rated the test panels on which 17 different staining materials had been applied to the 15 different wall finishes, their scores were amazingly similar in nearly all cases.

As might be expected, some materials stained some wall finishes to a greater degree than they did others. For instance, mild liquid detergent, hair oil, iodine and grape juice were either entirely removed or showed little effect on most materials while lipstick, liquid rouge, chlorophyll tooth paste and shoe polish left some degree of stain on nearly all materials. It was expected that iodine and merthiolate would stain materials rather badly but in only a few cases was the average score less than 4 points. This indicated only a very slight stain or change in color of the finish. A small degree of stain was caused by the liquid detergents when applied to the different finishes, while a much greater effect was caused by lipstick. It can be noted that tile and wall board were fairly resistant to stain whereas untreated wall-paper, casein and flat paints were very susceptible. In Table 1 it can be noted that the age of the stain and the cleaning materials used had some effect upon the amount of stain that remained on the finish.

^aSuch as Bon Ami.

^bSuch as Spic and Span, Soilax or Wetallene.

It is recognized that this study was limited and the durability of finishes after many washings could not be estimated. Whether or not the higher priced paints would hold up better under frequent cleaning as would be found in the home was not established. However, in the case of the gloss paints, the higher priced, Gloss No. 2, at \$9.10 per gallon was more resistant to stain than was Gloss No. 1 at \$7.95 per gallon. With nearly all stains, Gloss paint No. 2 scored higher than did No. 1. In the total scores given the 2 paints, Gloss No. 2 rated from 11 to 38 points higher than did Gloss No. 1 depending upon age of stain and method of treatment. Both of the semi-gloss paints scored higher than did Gloss No. 1.

There was considerable price differential between the two semi-gloss paints, No. 1 at \$7.21 and No. 2 at \$5.90 per gallon. However, the resistance of these two paints to stains was varied. In some cases, No. 1 was more resistant; in others the cheaper, No. 2, seemed to be better. One was not considered superior to the other.

Flat paints were similar in their resistance to stain and no appreciable differences in quality were noted; likewise, their prices were about the same. Both flat paints were more susceptible to stain than were any of the other types of paint used.

The two rubber-base paints, similar in price, were found to have fairly good resistance to stains. While they did not score as high as did the gloss and semi-gloss types they were better than the flat type. Neither brand was noticeably superior to the other.

The one-coat paint at \$8.40 per gallon and second in price to Gloss No. 2 scored close to gloss and semi-gloss paints and could be considered in the same class for cleanability. It might also be repeated that this paint was applied in a single coat to test panels because of the claim of the manufacturer that it gave satisfactory results with a single coat. All other test panels had been given two coats of the other paints. Considering the good results with one application of the one-coat variety, it is probable that the application of a second coat would have given even more satisfactory results.

While the casein paint did not score as high as gloss, semi-gloss and the one-coat type of paints, it did score higher than the rubber-base and flat types.

From the standpoint of stain resistance and washability, coated fabric might be considered in the same classification with the better grade gloss, semi-gloss and one-coat paints and can be considered a highly satisfactory finish.

Poorest in stain resistance and washability of any materials used was the so-called washable wallpaper. In some cases when stain was removed the color was very much affected. However, the results were considerably better when a clear lacquer designed as a finish to make wallpaper washable was applied. Two applications of the lacquer were given duplicate samples of the paper before staining materials were applied. This seemingly desirable treatment made the paper more resistant to stain than were surfaces treated with flat and rubber-base paints. This lacquer finish may be applied by brush or fabric roller. During preliminary work in this study it was found that colors in wallpaper which bleed with the application of water also tended to smear when the lacquer was applied with a brush. This lacquer is a relatively expensive finish so it is questionable that its application over a very cheap grade of wallpaper would be economical. It also gives a slight shine to the paper; so if used, it would be desirable to cover the entire papered area rather than just around light switches or certain problem areas as is sometimes suggested.

The material most stain resistant was the rigid material classed as wall board. The high gloss finish was baked on a pressed wood base. Only shoe polish gave a permanent stain that could not be removed. Lipstick, liquid rouge and crayon showed slight effects but were completely removed with mild scouring powder. This material scored 241 of a possible 255 points when cleaned with mild scouring powder.

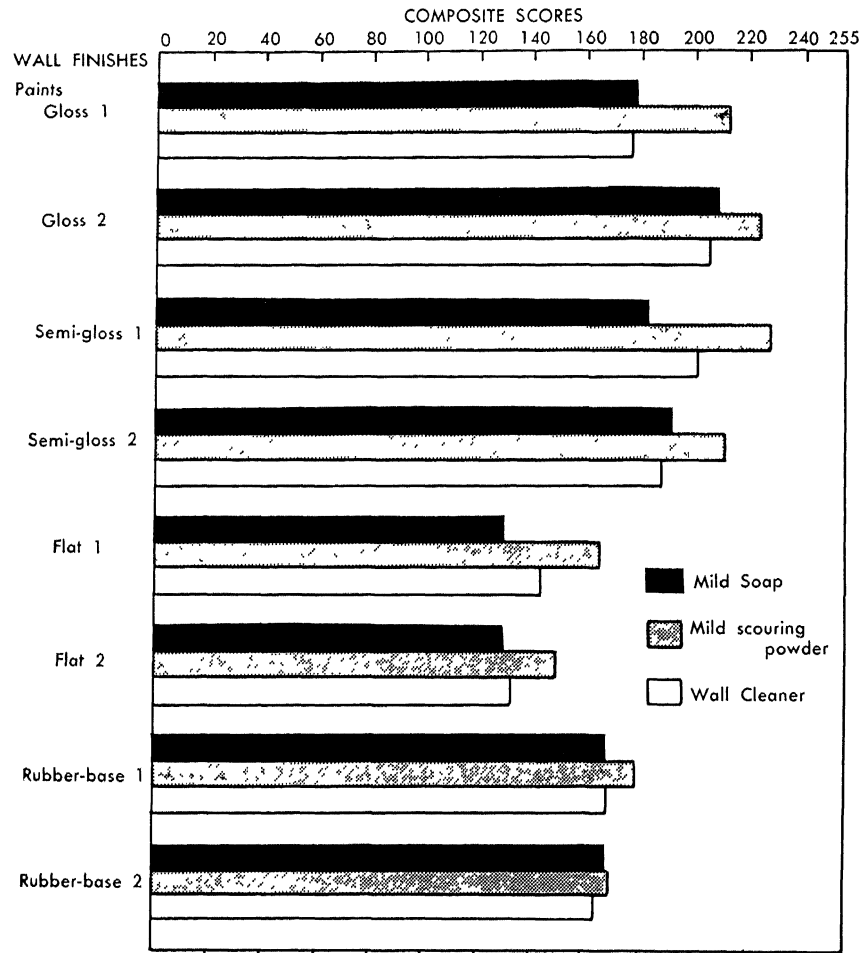
Like wall board, plastic and aluminum tile—with scores of 235 and 234, respectively—were more highly resistant to stains than were the other materials when cleaned with mild scouring powder. One characteristic of plastic tile noted was that it attracted dust. Some experiments since the completion of the study have shown that an occasional rinsing of plastic tile with water to which an anti-static solution has been added will reduce this undesirable characteristic.

Although laminated plastic panels, ceramic tile, vinyl and linoleum wall coverings were not included in this study they were subjected to stain tests when considered in a work counter surface study. It was found that laminated plastics and ceramic tile were highly resistant to stains. Vinyl and linoleum were susceptible to stains from such materials as mustard, food colorings, detergents, medical supplies, ink and shoe polish.

Cleaning Materials

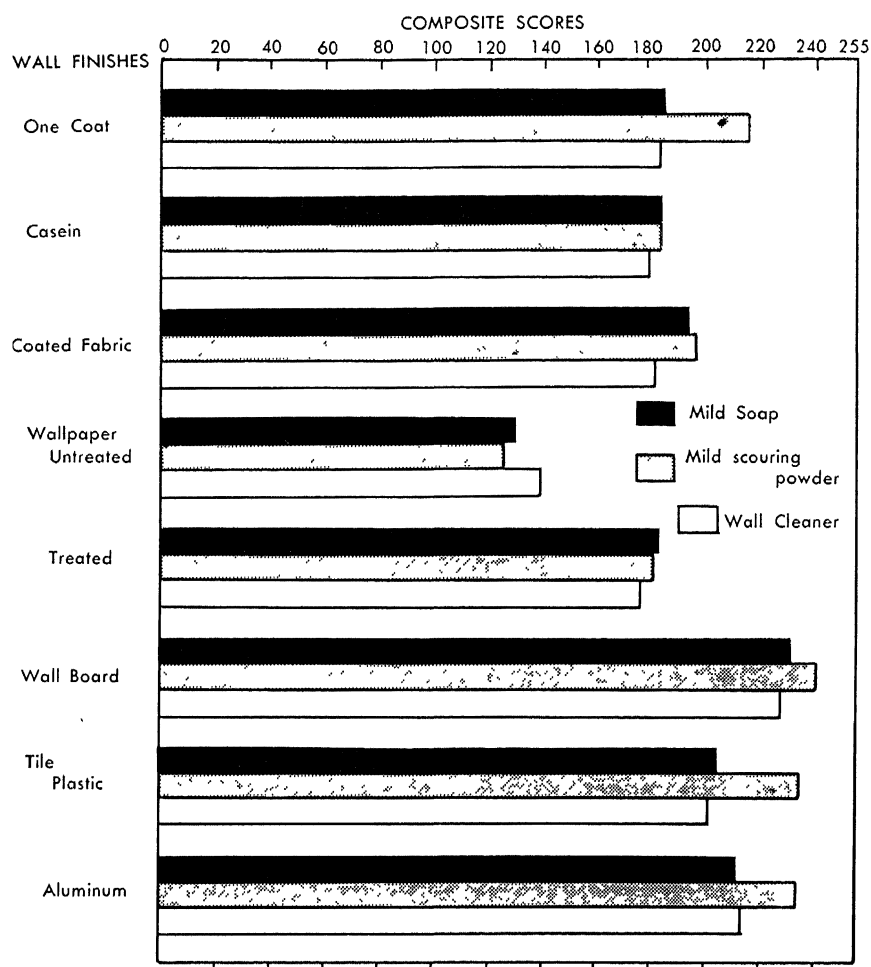
In the preliminary survey of 103 homemakers it was found that 37 different cleaning materials were used on wall finishes. However, one popular brand of special wall cleaner was used by 51 of the women.

CHART 1—Composite scores for wall finishes subjected to staining materials and washed with 3 forms of detergents after 2 hours.



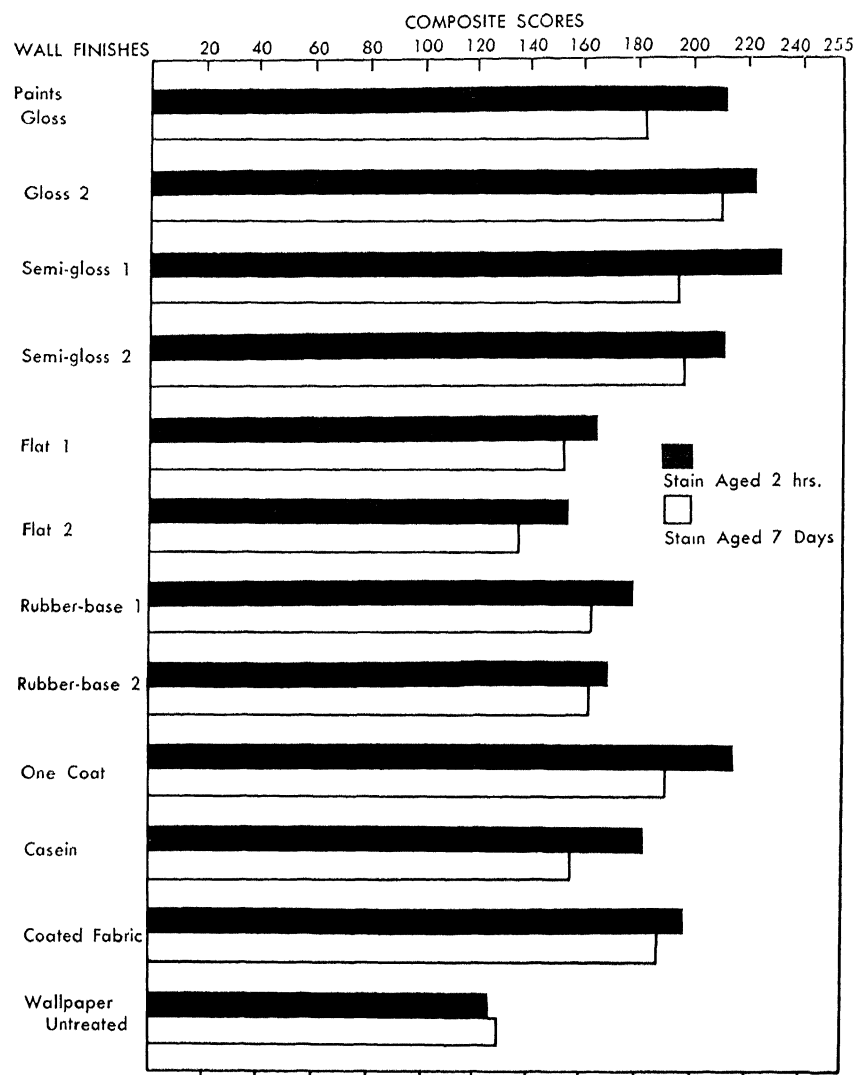
For this study a mild soap and this most popular brand of powdered detergent cleaner for walls and woodwork were used. In addition, a mild scouring powder was used in belief that stubborn stains not removed by the other cleaners might respond to the slight abrasive effects. However, it is not recommended that the abrasive cleaner be generally used. The results are reported in Charts 1 and 2 and Table 1.

CHART 1—Continued



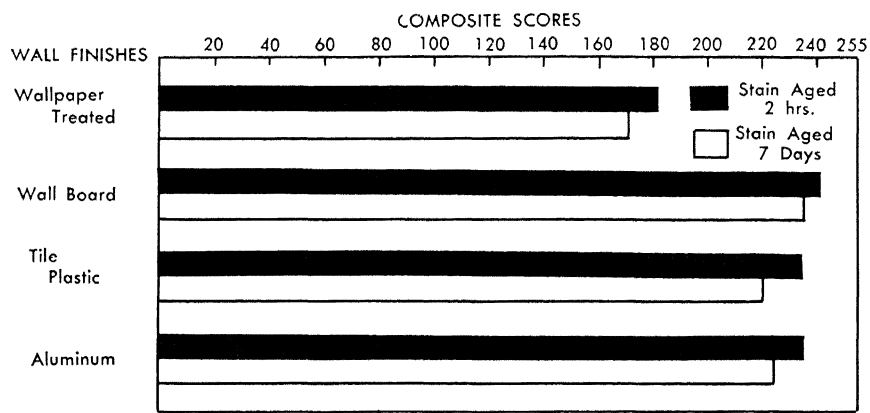
As can be noted on Chart 1 and Table 1, the results with mild soap and the special wall cleaner were quite similar and it cannot be said that one was superior to the other. The mild scouring powder was superior to the other two cleaning agents in removing stains from all wall finishes tested with the possible exception of wallpapers. On aluminum and plastic tile the wall cleaner and the mild soap were equally effective on fresh stains, but scouring powder was superior for both new and aged stains.

CHART 2—Composite scores for wall finishes subjected to staining materials and cleaned with scouring powder after 2 hours and after 7 days.



From the results in these tests, prompt removal of spots from materials that may stain the finish is desirable. In nearly every case the scores were higher on materials which were cleaned 2 hours after the staining material was applied than when it was allowed to remain for 7 days.

CHART 2—Continued



Light Reflectance Tests as a Measure for Stain Resistance

At the initiation of this study it was thought that some objective measure of stain retention on the various finishes would be a good supplement to the rating by the panel of judges. It was also thought that such a measure would indicate the loss of color or gloss of a finish.

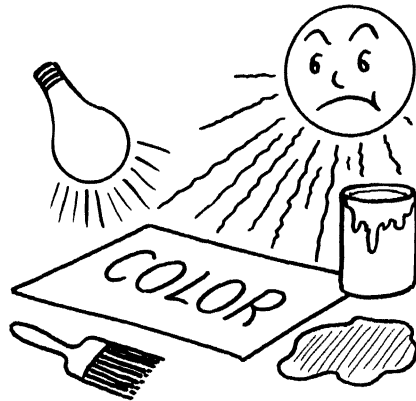
A Photovolt Reflectance Meter was used to measure the light reflectance of the finish of each panel prior to staining and after cleaning. A second reading was taken following the cleaning of the panels and compared with those of the original.

In some cases the remaining stain was hardly noticeable but the glaze of the finish was less pronounced than in the original. The reflectance readings indicated that a stain was more evident in some cases than in others. Sometimes the stain was quite obvious to the human eye, but was not so indicated by light reflectance. The objective test frequently indicated that stains aged 7 days and washed were less evident than stains aged 2 hours and washed. On the other hand, the judges' scores in practically every case indicated just the opposite.

Since the results were so widely varied and contributed nothing to the evaluation of the materials it seems unnecessary to further report the data.

Resistance to Sunlight

Large windows have gained in popularity and allow for more natural light in remodeled and new than in older style houses.



With southern and western exposures for kitchens and workrooms it is anticipated that many hours of direct sunlight will hit the wall finishes and/or cabinet finishes where paint may be applied. This question then arises: "Will the colors of finishes be fast to sunlight or will they darken, lighten or change from those in the unexposed areas?"

Specimens $2\frac{1}{2}$ by 4 inches were cut from test panels to which materials had been freshly applied and allowed to age for the same length of time as in previous tests. The test specimens were mounted in a masking holder so that approximately half of the area was exposed to artificial sunlight produced by an Atlas Fade-o-meter, model FDA-R for 48 hours at 100° F.

When specimens were judged only three materials showed any change from the original. In the cheaper priced gloss, semi-gloss and flat paints all made by the same manufacturer, the green color clouded. The gloss paint also appeared slightly darker than the original after exposure to sunlight.

It should be remembered that all finishes in this study were of a medium green color and these results might not necessarily apply to other colors, such as reds, which are known to be more susceptible to changes in direct sun exposure.

In the previous study dealing with materials for work counters among which some were suitable for wall finishes, similar tests indicated that green linoleum of a light color tended to fade slightly, green vinyl turned slightly yellow, the green color of one laminated plastic darkened slightly while that of another was unaffected.

COMPARATIVE COSTS OF DIFFERENT FINISHES

Although women interviewed indicated that such factors as ease in application and care were two of the most important factors in the selection of wall finishes it is probable that cost would also be an influencing factor. Thus one of the objectives in this study was to investigate the comparative costs of the finishes.

Wall finishing generally involves two costs—material and labor—unless the family follows the “do-it-yourself” plan. Material costs were easily estimated but labor costs were difficult to get. For example, several paper hangers were interviewed and their quotations ranged from \$.30 to \$.49 per single roll. Estimates of painters ranged from \$1.50 to \$2.75 per hour.

Considering only the costs of materials, paints were the least expensive. The average coverage for a gallon of paint is 500-600 square feet. Thus paints cost from \$0.007 to \$0.018 per square foot. Wallpaper costs range from \$0.01 to \$0.17 per square foot depending upon the type of paper. Coated fabrics were about the same price as a good grade of paper, or \$0.08 to \$0.10 per square foot. (See Tables 2 and 3.)

Prices of wall board ranged from \$0.10 to \$0.75 per square foot. Those with baked on paint ranged from \$0.10 to \$0.15. The more expensive had special designs such as marble or grained wood in various types of finishes.

Plastic tile ranged in price from \$.20 to \$.55 while aluminum tile with a synthetic enamel finish was from \$0.40 to \$0.47 per square foot. Ceramic tile was \$2.50 per square foot, but is one of the materials requiring skilled labor installation. Estimates for ceramic tile installed were \$2.50 per square foot. Laminated wall plastic averaged \$0.72 per square foot.

A kitchen 15 feet long, 10 feet wide and 8 feet high was used as a typical room for comparative price estimates. Method for calculation was:

Two walls, 15 ft. \times 8 ft.	240 sq. ft.
Two walls, 10 ft. \times 8 ft.	160 sq. ft.
One ceiling 15 ft. \times 10 ft.	150 sq. ft.
Total area	550 sq. ft.

From this area, the amount of space not to be finished is subtracted; namely,

Two windows, 4 ft. \times 3 ft.	24 sq. ft.
Two doors, 7 ft. \times 3 ft.	42 sq. ft.
Cabinets, 12 ft. \times 8 ft.	96 sq. ft.
Total area deducted	162 sq. ft.

550 sq. ft. less 162 sq. ft. leaves 388 sq. ft. to be covered.

These costs assume that a wainscoting will not be used; however, if it is desirable the cost may be calculated from the table given for calculation of wainscoting for bathrooms.

The second example is a bathroom 8 feet long, 5 feet wide and 8 feet high with a window 2 feet by 3 feet and a door 7 feet by 3 feet. It assumes that 4 by 4 foot wainscot of tile or wall board plus another finish above that area would be used.

	Total No. sq. ft.	Sq. ft. wainscot	Other finish
Two walls, 8 ft. \times 8 ft.	128 sq. ft.	64	64
Two walls, 8 ft. \times 5 ft.	80 sq. ft.	40	40
Ceiling, 8 ft. \times 5 ft.	40 sq. ft.	--	40
		<hr/>	<hr/>
		104	144
Deductions for window and door			
One door, 7 ft. \times 3 ft.	21 sq. ft.	12	9
One window, 3 ft. \times 2 ft.	6 sq. ft.	--	6
Total area to be covered		92	129

The cost of application of any material except paint will include not only that of the material but an additional amount for an adhesive. The cost of the adhesive has not been considered in these tables. It should be mentioned, however, that this item may add substantially to the cost of the finish; for example, plastic tile may cost \$.42 per square foot but the adhesive at \$5.50 per gallon (mounts 30-35 sq. ft.) would boost the actual cost to approximately \$.75 per square foot. The same would be true for other types of individually mounted wall tiles.

The cost of wallpaper paste would be small in comparison to that of the above-mentioned adhesives.

The lacquer finish suitable for making wallpaper more stain resistant and washable costs about \$.90 per quart. This amount will cover about 75 square feet. Since the first coat would be absorbed by the paper, it can be anticipated that the coverage would be greater for a second coat.

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APPENDIX

WALL FINISH MATERIALS USED IN KITCHENS, UTILITY ROOMS AND BATHROOMS

PAINT

Paints in general are a class of products called protective and decorative coatings. Because of the difference in purposes of use, the formulas for the ingredients are varied. The general types include:

Primer-sealer: Designed to seal surfaces and provide a suitable base for the application of finish-coat paints. It is essential over plaster for alkali resistance. May be clear in color or contain a pigment to help hide previous coats of paint.

Oil base: (1) **Flat** paints are high in pigment and oil content giving a matte finish. Good quality will have a slight sheen, while poor quality will not and is also porous. This type has a tight film resistance and good adhesive quality.

(2) **Semi-gloss** paints have more gloss, less pigment and oil content and more binders than flat paint. The surface is also less porous.

(3) **Gloss** paints are low in pigmentation and oil and high in binders. The particles are very fine giving a smooth texture and high gloss and have high light reflectance to the extent of glare.

Water Soluble Paints are those which use water as a thinner.

(1) **Whitewash** is a mixture of lime and water.

(2) **Calcimine** is made of glue and whiting. It has no sheen but serves well to mask irregularities on wall or ceiling.

(3) **Casein paints.** Some water paints purchased in paste or powder form use casein as a binder. They are fast drying, have high reflectance and do not react chemically with the lime in new plaster.

Water Emulsion Paints

Resin-emulsions are water thinned paints which use casein and oleoresins as binders and are considered to have better washability than paints using casein only.

Rubber-base paints are those in which natural or artificial latex is used in the formula. They are alkali resistant, odorless, quick drying and have a solid film that resists penetration of soil. They cannot be applied over metal.

One-Coat Paints

This group has combined characteristics of a sealer coat and a finish coat. The name does not necessarily mean that one coat is always adequate.

WALLPAPER AND COATED FABRICS

Wallpaper. The majority of wallpaper is made of wood pulp and emulsified rosin. Patterns are generally applied by either machine or silk screen printing. The following classification is often used:

Non-washable paper is water sensitive and cannot be cleaned with water unless a special lacquer preparation has been applied.

Water-resistant paper can be cleaned with water if done with caution.

Plastic-impregnated is as the name implies and can be readily washed.

Coated fabrics are made from closely woven cotton with several layers of a special fast drying paint made of oils and pigments which are baked on the surface.

RIGID MATERIALS

Rigid materials used for wall coverings are tile, wall board and glass.

Wall tile may be classified according to the material from which it is made.

Ceramic or clay: The main body is made of red or buff native clay and glazed in kilns at very high temperatures. Many colors and types of glaze are used for the final effect.

Enameled aluminum: Aluminum for wall tile is treated with hard chromium phosphate which serves as a barrier against corrosion. An enamel coating of an alkyd resin is applied and baked on.

Enameled steel: Twenty-eight gauge steel tiles are galvanized or coated with zinc to prevent corrosion. They are coated with a synthetic alkyd resin enamel which is baked on.

Plastic: The raw material for plastic tile is polystyrene in granular form, which is molded at high temperatures.

Wall board may be classified according to the type of fabrication.

Finished hardboard: Boards with baked enamel coatings making them moisture resistant. They are sometimes scored to give a tile effect.

Plasterboard: Wall board made of gypsum with both sides ordinarily covered with a tough paper. Sometimes made with a pre-finished paper face that is sealed. Generally not good for high moisture areas.

Plywood is made of several thin layers of natural wood.

Pressed wood is made of natural wood pulp, treated and pressed to board form in hydraulic press. Boards are tempered in hot oil and humidified to return the natural amount of moisture.

Glass for wall finishes is used in three forms:

Bricks which are cemented together;

Structural glass, which forms partitions, may be flat or corrugated; and

Glass squares which can be applied as tile.

All forms of glass may be had in translucent or transparent forms and in varieties of color.

FLEXIBLE MATERIALS

Flexible materials are, as the name implies, finishes for decorative special purposes such as water repellancy. They are generally applied to a basic wall by means of an adhesive.

Baked enamel on felt: Enamel paint baked on to a felt paper.

Laminated plastics: Layers of paper or fabric impregnated with synthetic resins and fused together under heat and pressure, making a solid material that cannot be separated.

Linoleum: This material is made of linseed oil, cork, resins, color pigments and wood gum fused to a fabric or paper backing.

Vinyls: These are flexible materials made of synthetic resins, coloring matter, plasticizers and fillers fused together.

Wood veneer on canvas can be applied like wallpaper and looks like wood paneling.

Cork wall tile is made from cork curlings from the cork oak tree and baked at high temperature under pressure

TABLE 1.—Composite Scores* for Wall Finishes Subjected to Staining Materials and Washed with 3 Forms of Detergents

Wall Finishes	Detergents Used to Wash Stained Surfaces					
	Mild Soap		Mild Scouring Powder		Wall Cleaner†	
	Age of Stain		Age of Stain		Age of Stain	
	2 hours	7 days	2 hours	7 days	2 hours	7 days
Paint						
Gloss 1	178	154	212	183	176	160
Gloss 2	208	192	223	211	205	187
Semi-gloss 1	182	164	227	195	201	177
Semi-gloss 2	192	173	211	196	184	166
Flat 1	130	124	165	153	144	130
Flat 2	130	122	155	137	133	126
Rubber-base 1	168	148	179	163	169	145
Rubber-base 2	168	158	170	162	165	161
One-coat	185	167	216	191	183	162
Casein	183	148	183	156	179	162
Coated Fabric						
	194	177	197	188	182	179
Wallpaper						
Untreated	130	124	126	129	139	163
Treated	183	165	181	171	176	168
Wall board						
	227	220	241	235	228	221
Tile						
Plastic	204	211	235	220	202	207
Aluminum	212	187	234	224	214	199

*Each figure indicates the total score for 17 stains. Highest possible score was 255.

†Synthetic detergent marketed for wall and woodwork cleaning.

TABLE 2.—Estimated Comparative Cost of Some Wall Materials for a Kitchen 10 × 15 × 8 Feet with 388 Square Feet of Wall Area*

Materials	Unit of Purchase	Cost per Unit	Cost per Square Foot	Cost per Room
Paint				
Gloss	Gallon	\$6 30 to \$8 95	\$0 013 to \$0 018	\$ 5 04 to \$ 6 98
Semi gloss	Gallon	4 30 to 8 95	0 007 to 0 018	2 71 to 6 98
Flat	Gallon	4 75 to 8 15	0 008 to 0 016	3 10 to 6 21
Casein	Gallon	4 19	0 007	2 71
Resin-emulsion	Gallon	3 65		2 33
Rubber base	Gallon	5 45 to 5 85	0 009 to 0 011	3 49 to 4 27
Wallpaper				
Water sensitive	Single roll	0 30 and up	0 01 and up	3 88 and up [†]
Water resistant	Single roll	0 59 to 4 00	0 016 to 0 110	6 21 to 42 68 [†]
Scrubbable	Single roll	1 59 to 6 00	0 040 to 0 170	15 52 to 65 96 [†]
Pre pasted	Single roll	1 15 to 3 00	0 030 to 0 080	11 64 to 31 04 [*]
Coated fabric	Single roll	2 90 to 3 55	0 080 to 0 100	31 04 to 38 80 [*]

*A Study of Sources and a Compilation of Consumer Information on Interior Wall Finishes. Katherine Brundlett Bailey, 1954. Unpublished Master's thesis, The Ohio State University, page 147.

[†]Assuming that ceiling would be finished with same material as the walls. If ceiling is to be painted, deduct cost of 150 square feet of covering and add cost of 150 square feet of paint.

TABLE 3.—Estimated Comparative Costs of Some Wall Materials for a Bathroom 8 × 5 × 8 Feet with a Four Foot Wainscot* †

Materials for wainscot	Cost per square foot	Estimated Cost for Wainscot	
		Installed	Material only
Tile			
Ceramic	\$2.50‡	\$230.00	
Enameled aluminum	1.30‡ 0.40 to 0.47	110.40	\$38.64
Plastic	1.50‡ 0.20 to 0.55	119.60	18.40 to 50.60
Wall board			
Finished hardboard	0.35 to 0.75		32.20 to 69.00
Baked enamel on felt	0.10 to 0.15		9.20 to 13.80
Laminated Plastic	0.72		66.24

*A Study of Sources and a Compilation of Consumer Information on Interior Wall Finishes. Katherine Brundlett Bailey, 1954, Unpublished Master's thesis, The Ohio State University, page 148. Adapted.

†Assuming that a gloss paint would be used to finish wall and ceiling above wainscot, add \$1.67 to \$2.32 for each cost (129 square feet times \$0.013 or \$0.018).

‡Estimated price, labor and materials.

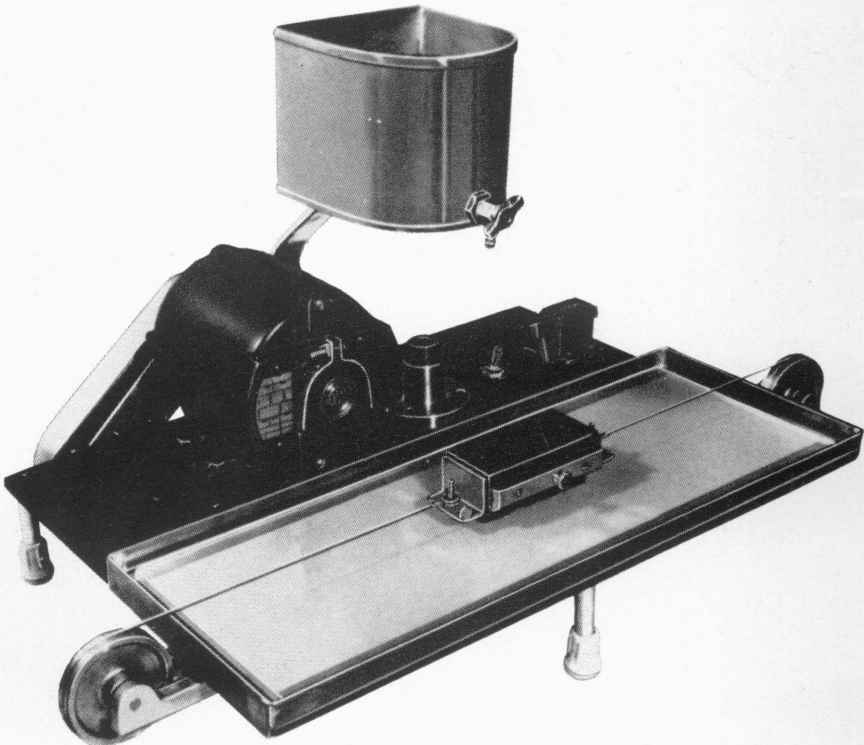


Fig. 1.—Gardner Washability and Abrasion Testing Machine